

**Northeast Coastal and Barrier Network
Protocol Development Summary**
(Sept. 2005)

Protocol: **Salt Marsh Sediment Elevation**

Parks Where Protocol will be Implemented: *CACO, GATE, FIIS, ASIS, GEWA,
COLO*

This version is appended, adapting the CACO protocol summary for the Northeast Coastal and Barrier Network. The original version was adapted from the CACO 2002 Conceptual Framework Update. The Framework Update, protocols, and reports are available at <http://www.nature.nps.gov/im/units/caco/index.htm>. *Additional information for the NCBN – wide protocol is in italics throughout the document.*

Justification/Issues being addressed:

The mean elevation of salt marsh surfaces must increase to keep pace with the annual rise in sea level and subsidence of salt marsh organic substrates. If the sedimentation rates in a salt marsh do not equal or exceed the net loss in elevation due to the steady increase in sea level and salt marsh subsidence, it will “drown”. When a salt marsh “drowns”, the surface of the marsh becomes sub-tidal which can cause drastic habitat changes such as the conversion of vegetated salt marsh to unvegetated mud flat.

As recognized in the 1999 Conceptual Framework (Roman and Barrett 1999), understanding changes in relative salt marsh elevation is important for interpreting changes in salt marsh vegetation communities and other estuarine ecosystem components. Salt marsh erosion and accretion are also important parameters for measuring the response of formerly impounded marshes to restoration of tidal influence, and will be particularly critical if the rate of sea level rise accelerates as predicted.

In addition to monitoring sediment elevation changes in CACO's salt marshes, this project is also part of a worldwide effort to monitor sea level rise with sediment erosion tables (SETs) (Boumans and Day Jr. 1993) and cryogenic coring devices (Cahoon et al. 1996). These two techniques measure the amount of erosion and accretion on salt marsh surfaces.

Vital Sign: salt marsh sediment elevation change
Measures: relative elevation, sediment accretion

Monitoring questions:

1. Is the rate of sedimentation in CACO salt marshes adequate to prevent these marshes from drowning?
2. What is the response of marsh surface elevation to tidal restoration projects?
3. Are salt marsh sediment elevation changes correlated to changes in other biologic systems?

NCBN Monitoring Objectives, Questions, and Vital Signs

<i>Objective 1: To understand how salt marsh elevations respond to local sea-level rise</i>
<i>Question 1: Are salt marsh surface elevation trajectories changing over time (e.g., decades), and if so, what factors are contributing to observed elevation changes (e.g., surface versus subsurface processes, changes in organic matter accumulation)?</i> <i>Vital Sign: Salt Marsh Sediment Elevation</i>
<i>Question 2: Are salt marsh surface elevation trajectories keeping pace with the local rate of sea-level rise?</i> <i>Vital Sign: Salt Marsh Sediment Elevation</i>

Basic approach:

Salt marsh sediment elevation change is measured using SETs; sediment accretion is measured using marker horizons and either cryogenic corers or the "marsh plug" method. Both these techniques are described in detail at the USGS SET web site at: <http://www.pwrc.usgs.gov/resshow/cahoon/>

SET and marker horizon sites are established at Hatches Harbor (Provincetown), Herring River (Wellfleet), and Nauset Marsh (Eastham). At Hatches Harbor and Herring River, SET/marker horizon sites are located above and below tidal restrictions to capture changes associated with tidal restoration in addition to measuring the response of the unimpaired marsh to sea level rise. At Nauset Marsh, sampling sites are located on the marsh surface and in marsh pools to measure response to sea level rise. Data is collected twice per year.

The data collected by this protocol will be helpful for interpreting changes in salt marsh vegetation and, over the long-term, possibly benthos, nekton, and migrating waterbirds.

Principal Investigators And NPS Lead:

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Protocol Development: Don Cahoon, USGS

For NCBN – wide protocol

Protocol Development: Don Cahoon, USGS

NPS Lead: Bryan Milstead

Development/Operations Summary:

Sediment elevation has been monitored at Hatches Harbor and Nauset Marsh since 1998, and at Herring River since 2000. We are considering expanding this project to East Harbor (Truro) and Pleasant Bay (Orleans/Chatham) if program capacity allows. At East Harbor, the goal would be to capture changes associated with tidal restoration.

Expanding this project to Pleasant Bay would measure response to sea level rise, but more importantly, could also shed light on recently observed conditions that may be early signs of marsh drowning.

The methods used are well established and documented by USGS. A CACO-specific protocol is being developed by USGS, using USGS funds, and should be available in draft sometime during FY2004. Results from sediment elevation monitoring in Hatches Harbor are described in a Fall 2003 Park Science article about the Hatches Harbor restoration project (Portnoy et al 2003)

Development Schedule, Budget, and Expected Interim Products

The draft protocol, adapted for GATE, FIIS, ASIS, GEWA, and COLO, is expected in March 2006, and the final protocol is expected by March 2007..

CITATIONS:

Boumans, R.M.J. and J.W. Day Jr. 1993. High Precision Measurements of Sediment Elevation in Shallow Coastal Areas Using a Sediment-Erosion Table. *Estuaries* 16 v2: 375-380.

Cahoon, D.R., Lynch, J.C. and R.M. Knaus. 1993. Improved Cryogenic Coring Device for Sampling Wetland Soils. *Journal of Sedimentary Research* 66 no.5:1025-1027.

Portnoy, J., C. Roman, S. Smith, and E. Gwilliam. 2003. Estuarine habitat restoration at Cape Cod National Seashore: The Hatches Harbor prototype. *Park Science* v22 no 1: 51-58.

Roman, C.T., and N.E. Barrett. 1999. Conceptual Framework for the Development of Long-term Monitoring Protocols at Cape Cod National Seashore. Technical Report, USGS Patuxent Wildlife Research Center, Coastal Research Field Station, Narragansett, RI. 59p.